

# **ETV Drinking Water Systems (DWS) Center**

**For EPA Science Forum**

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**May 18, 2005**



# **Drinking Water Systems (DWS) Center:**

## ***History & Background***

- ◆ **The DWS center is one of six ETV centers.**
- ◆ **Began October 1995 with focus on small systems technology needs.**
- ◆ **Protocols provide uniform testing and quality control procedures.**
- ◆ **Testing primarily performed in the field.**
- ◆ **State collaboration necessary for acceptance & support.**
- ◆ **Next phase: private sector & non-EPA financial support .**

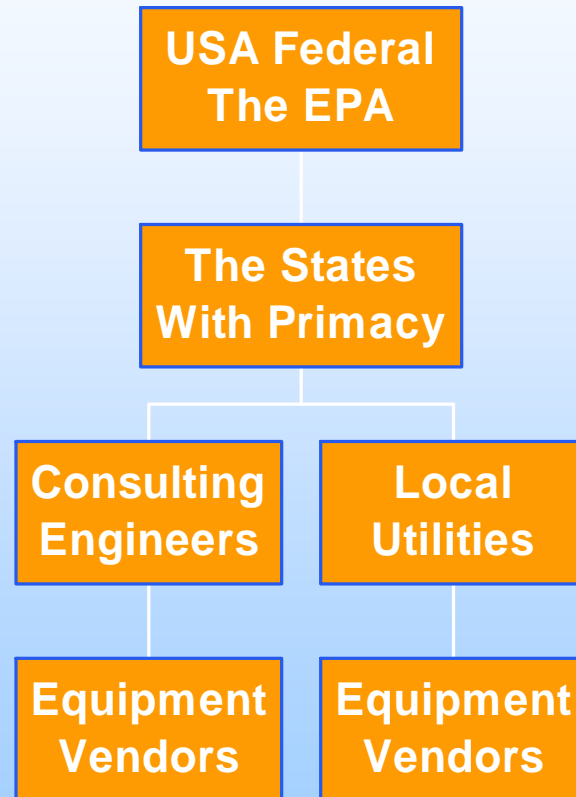


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# USA Drinking Water Regulations

## *Relationships*



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# States Support

- ◆ ASDWA involved and supported ETV DWS Center since inception.
- ◆ Annual states survey showed increasing ASDWA member support.
- ◆ States review of protocols, test plans, and reports. Provide input and improvements in protocols.
- ◆ States use ETV reports in approving alternative technologies.
- ◆ States represented on Steering Committee.



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# Stakeholders Collaborate on Pre-Test Protocols

- ◆ Expert researches and writes draft protocol.
- ◆ Another expert performs technical review.
- ◆ Interested stakeholders and all 50 states review draft protocol.
- ◆ The stakeholder committee reviews and recommends final draft protocol.
- ◆ The EPA and NSF independently QA review protocol and consider use in ETV tests.
- ◆ After used in ETV test, stakeholder feedback basis for modifications & improvements.



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# ETV DWS Center: Arsenic Technologies

Technology	Completed	In Progress	Pending
Reverse Osmosis (RO)	3	0	0
Coagulation with Filtration	3	2	0
Adsorption (disposable, ion exchange or regeneration)	2	1	0
TOTAL	8	3	0



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# Collaborative Efforts (a)

## ◆ State of Utah:

- Park City, Utah.
- Laboratory analyses (\$25K).
- Reviewed test plans & reports.

## ◆ State of Pennsylvania:

- Small systems (orchard hills mobile home park & Hilltown township).
- Lab analyses (\$30K in-kind)
- Cash contributions (\$20K)
- Reviewed test plans & report.



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# Collaborative Efforts (b)

## ◆ State of Alaska & EPA OGWDW:

- Technical assistance center.
- Small systems (Southwood Manor).
- Field & lab testing (\$50K in-kind).
- State reviewed test plans & reports.

## ◆ State of Michigan:

- Small systems (St. Louis Center & Oakland county drain commission).
- State reviewed test plans & reports.



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# Participating Arsenic Technologies

## ◆ Chemical coagulation.

- Pre-engineered skid mounted package plants, (ferric chloride addition followed by flocculation and then filtration).
- In-line chemical feed (rapid mix) with direct filtration (no flocculation step using microfiltration membrane).
- Oxidation of natural iron to form hydroxide floc to co-precipitate arsenic, then direct filtration.
- Remote sensing & control of chemical feed and operations.



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# Coagulation Package Plant Tested



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# Participating Arsenic Technologies

## ◆ Media:

- Iron coated natural substrate.
- Iron treated activated alumina.

## ◆ Reverse osmosis:

- Membrane modules with backwash and cleaning cycles for re-use (conventional approach, measure flux and water production).
- Skid system with low pressure RO with limited periodic cleaning and/or membranes disposed for small system applications.



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# Typical Arsenic Media Tested



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# RO Modules Tested



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# Arsenic Technology Test Results

- ◆ All but one verified technology reduced arsenic consistently below the MCL of 10 ppb.
- ◆ Most achieved arsenic reductions to the reportable detection limit (~ 2 ppb).
- ◆ Preliminary test results of technologies in progress have similar trends.
- ◆ Performance greatly influenced by water quality & process parameters.

# Arsenic Technology Test Results

- ◆ Operational parameters measured with varying results:
  - Chemical consumption.
  - Electrical power.
  - Labor.
  - Ease of use estimated.
- ◆ Example:
  - Chemical feed pump break downs.

# *Impacts & Outcomes*

- ETV provides information to help States, utilities, and other organizations select appropriate water treatment technologies to meet the 10 ppb arsenic regulatory standard.
- Many of the ETV verified technologies demonstrated the capability to reduce arsenic levels in drinking water to 5 ppb or less.
- This provides several available alternatives for off-the-shelf technology products to the estimated 4,100 drinking water systems anticipated to be required to install treatment to meet the new arsenic standard.



# Impacts & Outcomes

- Arsenic in drinking water is a known carcinogen with additional adverse human health impacts.
- EPA estimated health benefits of arsenic reduction in its EA 2000 report (EPA-815-R-00-026).

## Annual Total Cancer Cases Avoided from Reducing Arsenic in the 4100 CWSs and NTNCs

Arsenic Level (ppb)	Reduced Mortality Cases	Total Cancer Cases Avoided
3	32.6 – 74.1	57.2 – 138.3
5	29.1 – 53.7	51.1 – 100.2
10	21.3 – 29.8	37.4 – 55.7



# *Impacts & Outcomes*

- Many ETV verified technologies may be applicable as treatment for most of the estimated 4,100 systems affecting 12.7 million people, but a more conservative case is presented here.
- The estimated 100% potential market for ETV technologies includes the 3,900 smaller community systems affecting about 4.4 million people.
- Economic benefits of lung and bladder cancer prevention by ETV verified arsenic treatment technologies are estimated for different market penetration scenarios.



# Impacts & Outcomes

## **Estimated Health Benefits of Lung & Bladder Cancer Prevention by ETV Arsenic Treatment Technologies ( \$ Millions per year).**

Market Penetration	Lower Bound	Upper Bound
10 %	4.8	6.8
25 %	12.1	17.1

The above estimated economic benefits do not include other combined health benefits for liver, kidney, skin, & prostate cancers; cardiovascular, immunological, neurological, & endocrine effects.



# *Impacts & Outcomes*

- State agencies have indicated that ETV studies may help minimize pilot testing requirements and help expedite the approval and implementation of arsenic treatment technologies at sites.
- Assume a \$20K pilot testing cost, and a reduction in pilot studies for ETV technologies ranging from 10% - 75% required.
- For a 10% market penetration of ETV verified systems, estimated pilot testing savings may range from about \$800K to \$5M.
- Also, ETV results help provide technology vendors with valuable data on product weaknesses that may be addressed in subsequent product modifications.

